EFFECT OF PALM OIL WASTE AND QUARRY DUST ON THE PROPERTIES OF HYBRID BLOCKS

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DEDICATION

To the one who was always burning day and night to make me shine and glitter…….

To the one who was always giving me everything without return……….

To the one who was always giving me the sense of safety and peacefully……..

To the one who was always with me side by side………

To the one whom I could never accomplish my research without his massive sustenance

To the light of my life……..

To my beloved husband. …….

I would like to dedicate him this work and tell him how am grateful for your existence in my life.

Alaa Ahmed Shakir

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ABSTRACT

Accumulating unmanaged palm oil wastes and quarry dust has resulted in an increasing environmental concern. Recycling of quarry dust and palm oil wastes like the palm oil fuel ash and the palm oil clinker as building materials appeared to be a viable solution to such a pollution problem and the problem of buildings' economic design. Therefore, this research is the first attempt to produce hybrid interlocking blocks from palm oil waste and quarry dust. Hybrid interlocking blocks (HIB) were produced by mixing palm oil fuel ash, palm oil clinker, palm oil clinker powder, and quarry dust with merely 10% cement by various constitutes. The production methodology using proposed new mix design, neither exhausted the virgin material of earth nor consumed energy resources or emitted contamination, with significant economic and ecological benefits. HIB blocks were tested for engineering properties such as the density, compressive strength, ultrasonic pulse velocity (UPV), modulus of rupture, water absorption, a compressive strength of prisms, efflorescence, thermal conductivity, and leachability. Furthermore, the investigation on the durability of the blocks in laboratory accelerated tests and actual climatic exposure for 12 months also have been conducted. The hardened density ranged in 852.82 kg/m^3 and 1561.21 $kg/m^{3,}$ and the compressive strength of the blocks ranged from5.01 MPa to 14.57 MPa, respectively. Meanwhile, UPV ranged in 1.25 km/s and 2.67 km/s. Furthermore, the modulus of rupture ranged between 0.69 MPa and 3.71 MPa; water absorption varied from 13.18% to 21.94%. The compressive strength of prisms ranged in 2.35 to 6.85 MPa, meanwhile, thermal conductivity filled in the range between 0.27 w/m k and 0.136 w/m k, respectively. Results for the leachability and the durability were rewarding and promising. The block's properties satisfied the relevant thresholds and were better than the properties of the conventional stabilized compressed

The mix design proposed in this research, especially mix A"11, which considered as optimum mixture showed acceptable results in terms of the properties of the block. In conclusion, the blocks developed in this research can be classified as lightweight and thermally efficient. They can be used as substitutive to the conventional blocks in the building construction sector.

ABSTRAK

Pengurusan sisa kelapa sawit dan debu kuari yang tidak cekap telah meningkatkan kebimbangan kesannya terhadap alam sekitar. Kitar semula sisa debu kuari dan sisa kelapa sawit seperti abu bahan bakar kelapa sawit dan klinker kelapa sawit sebagai bahan binaan merupakan satu pendekatan yang sesuai untuk menyelesaikan masalah pencemaran dan masalah rekabentuk bangunan yang menjimatkan. Oleh yang demikian, penyelidikan ini adalah merupakan usaha awal untuk menghasilkan blok saling kekunci yang dibuat menggunakan sisa kelapa sawit dan habuk kuari. Blok saling kekunci hibrid (HIB) ini dihasilkan dengan mencampurkan abu bahan bakar kelapa sawit, klinker kelapa sawit, serbuk klinker kelapa sawit, debu kuari serta 10% simen dengan beberapa nisbah campuran yang berbeza. Metodologi penghasilan blok ini yang menggunakan cadangan rekabentuk campuran yang baharu, tidak menjejaskan bahan sumber semulajadi bumi atau menghabiskan sumber tenaga atau mengeluarkan bahan-bahan pencemaran dengan member faedah terhadap ekologi dan penjimatan bahan yang ketara. Sifat-sifat kejuruteraan batu blok seperti ketumpatan, kekuatan mampatan, halaju nadi ultrasonic (UPV), modulus kepecahan, penyerapan air, kekuatan mampatan prisma, efflorescence, keberaliran haba dan leachability telah diuji. Selanjutnya kajian terhadap ketahanlasakan blok dalam ujikaji makmal yang dipercepat dan pendedahan terhadap persekitan yang sebenar juga telah dijalankan untuk tempoh selama 12 bulan. Daripada hasil ujikaji didapati ketumpatan blok keras adalah antara 852.82 kg/m^3 dan 1561.21 kg/m^3 dan kekuatan mampatan blok masing-masing antara 5.01 MPa hingga 14.57 MPa. Manakala keputusan untuk ujikaji UPV pula adalah diantara 1.25 km / s dan 2.67 km / s. Selanjutnya, dapatan untuk modulus kepecahan adalah antara 0.69MPa dan 3.71 MPa serta kadar penyerapan air adalah dari 13.18% hingga 21.94%. Bagi kekuatan mampatan prisma pula keputusan menunjukan bacaan diantara 2.35 hingga 6.85 MPa

manakala tahap keberaliran haba pula berada dalam julat antara 0.27 w / m k dan 0.136 w/m k,. Keputusan terhadap leachability dan ketahanlasakan adalah sangat memuaskan. Kesimpulannya, sifat-sifat batu blok yang dihasilkan memenuhi ambang yang relevan dan lebih baik daripada sifat-sifat batu blok tanah mampatan konvensional (SCEB). Rekabentuk campuran yang dicadangkan dalam kajian ini terutama rekabentuk campuran A yang merupakan campuran optimum telah menunjukkan keputusan sifat-sifat kejuruteraan blok yang baik dan boleh diterima. Kesimpulannya, blok yang dihasilkan dalam kajian ini dapat diklasifikasikan sebagai blok yang ringan dan cekap terhadap haba. Ianya boleh digunakan sebagai pengganti batu blok konvensional dalam sektor pembinaan bangunan.

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